AMATEUR SATELLITE REPORT

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Ariane V-20 Launch Success Edges Phase 3C Towards March Launch

The AMSAT Phase 3C satellite edged a bit closer to launch late in November when Arianespace, the marketing arm of the European Space Agency, notched its second launch success in a row. Meanwhile, in West Germany, the critical series of final tests is being performed on Phase 3C prior to its shipment to the launch facility (see related story in this *ASR*).

The Ariane V-20 mission, the twentieth in the European consortium's ambitious program, lifted off its pad in Kourou, French Guiana, at precisely 02:19 UTC, Saturday, November 21. The launch was completely nominal with no holds or delays. The liftoff occurred just as the planned launch window opened. The window extended from 02:19 until 03:23 UTC.

Performance of the Ariane 2 launcher was precisely as expected. Orbital insertion of the payload, the TVSAT-1 satellite, to a geosynchronous transfer ellipse, occurred over Africa about 15 minutes after liftoff as the third stage attained a velocity of 9.8 km/second.

The success of the V-20 mission comes two months after the success of Ariane V-19, an Ariane-3 rocket. The V-20 launch had been scheduled for November 16 but ground control problems believed associated with the payload caused a delay to the 21st.

The TVSAT-1 is a joint project of the Federal Republic of Germany and France. It is a direct broadcast satellite using Ku band and will permit consumers to tune in directly to television broadcasts using only 1 meter diameter dishes or less. TVSAT-1 is designed primarily to serve Germany. TVSAT-2, serving France primarily, will be launched as early as April, 1988. TVSAT is among the largest and most powerful commercial satellites built. It weighs 2.2 metric tons and its solar arrays generate 3.2 kW of power at start of life. This power is needed to run the powerful Ku band Traveling Wave Tubes (TWT). These TWTs and the tight Ku band spot beam pattern allow the use of the small dishes on the ground.

At press time a potentially serious problem loomed in TVSAT-1's future, however. According to European sources, one of the solar panels had failed to deploy properly. If uncorrected, this could reduce power availability by at least 50%. Plans were being formulated to attempt to jar the panel loose while the satellite was in its geosynchronous orbit by using all of the satellite's station-keeping thrusters ignited at once.

Next in line for launch is V-21. This launch had been scheduled for early January but Arianespace has announced a delay in V-21 because of concerns over the vehicle's third stage cryogenic engine. V-21 is again an Ariane 3. It is to carry two geosynchronous satellites. The concerns about the third stage engine were that the hydrogen turbopump bearings had experienced some high temperatures in testing. Although the temperatures were acceptable to technicians, these data were new and not well understood program officials said.

In line with management's very conservative approach following the V-18 debacle, the decision was taken to change out the engine. This will delay V-21 up to 6 weeks Arianespace said. (Unofficial estimates have V-21 lifting off on February 3.) This delay may ripple through the schedule and affect V-22 and AMSAT's Phase 3C. The effect could be to slew the V-22 launch towards the end of March. AMSAT management said this was being accounted for in its planning to support the launch of V-22 at Kourou.

The V-20 launch countdown was heard by many AMSAT members over a special AMSAT Launch Information Network Service (ALINS) carried on AMSAT OSCAR 10. The net drew hundreds of listeners from North and South America as well as Europe. The ALINS originated with WA2LQQ in New York who was tuned into the Arianespace broadcast from Kourou channeled to North America on GTE Spacenet 1, a commercial broadcast satellite operating at C-band.

Hundreds heard the countdown to launch in real time and then followed the progress of the launcher and satellite as they went through to satellite deployment and insertion into GTO. The ALINS was carried on the AMSAT Coordination and Net Frequency (ACNF) of 145.957. AO-10 was ideally positioned over the Caribbean for the ALINS and the launch fit well into the operating schedule. A worldwide ALINS is planned for the V-22 launch according to VP Operations WØRPK.

Polar Skitrek Team On Baffin Island For Advanced Training

Russian participants in the joint Canadian-Russian Skitrek project travelled to Frobisher Bay (69N, 64W) on Baffin Island, Canada, November 23 after having arrived in Montreal on the 20th. A special event station has been established at Frobisher. The primary purpose of the Frobisher station is to support the actual skiers beginning next February.

AMSAT and the University of Surrey have made plans to support the Skitrek with Project Nordski Comm. Skiers will use a combination of COSPAS/SARSAT and UoSAT OSCAR 11 resources to reckon their position. The UoSAT-2 Digitalker will be programmed to articulate the skier's position based on data received via Telex from the COSPAS/SARSAT Mission Control Center. (See *ASR* #162)

Educators are planning to use the UoSAT-2 Digitalker for students to plot the trekker's progress across the pole on maps. UoSAT-2 can often be heard using only an HT and rubber duck antenna. Many general purpose scanners will be tuned to this project educators have told AMSAT. Since UoSAT-2 is in a polar orbit, the trekkers will be able to hear it on every single orbit.

The Skitrek team will be carrying 2 meter HTs. ICOM America is providing its micro 2AT HTs for the Skitrek. According to Bill Everett, K7RIE, ICOM America's Engineering Manager and an avid AMSAT member, the micro 2AT has been tested down to -40 degrees Celsius. The published specs go down to -10 degrees but Bill told *ASR* the HT's receivers will work even at the lower temperatures.

Accompanying the Russian team arriving in Canada was Leonid Labutin, UA3CR. Leo is the Russian team's chief radio operator and a veteran of polar expeditions himself although on this project he will operate from the support base. AMSAT's John Henry, VE2VQ, met with Leo near Ottawa November 22 to discuss the polar expedition and several other joint projects on the drawing boards.

Canadian Amateurs are supporting the project en masse. Under the leadership of CRRL President Tom Atkins, VE3CDM, the Canadians have assembled an impressive team of Amateur Radio communicators including well known DXer Barry Garratt, VE3CDX. Garratt will be among the select team operating from Frobisher. The CRRL is acting as expedition coordinator for all Canadian Amateur Radio activities supporting the project.

Meanwhile, on the regulatory front, the CRRL says the Canadian Department of Communications has announced the signing of an historic Third Party Agreement with the USSR for the period November 1 through the conclusion of the polar expedition. This agreement is necessary in order to allow non-Amateur trekkers to communicate via Amateur resources.

Phase 3C Launch Preparations Accelerate

The Phase 3C spacecraft was due to begin an intensive series of tests at press time. According to Dick Daniels, W4PUJ, who travelled to West Germany for the tests which were scheduled to begin November 30, the critical test of the new propulsion system was high on the test agenda. The tests were to use isopropyl alcohol and nitrogen to simulate the actual explosive propellants. Later, the important shake and vibration tests were to be performed on the fully assembled spacecraft. A further thermal vacuum test of selected modules was also said to be under consideration at press time.

The tests are being performed at the facilities of AMSAT DL in Marburg and other facilities including those of MBB, the maker of the bi-propellant kick motor.

New UoSAT-2 DIARY Testing Proceeding

The week of November 22 saw the first tests of a new DIARY program for UoSAT-2. The new DIARY has been developed by OBC programmer Steve Holder and ADCS researcher Paul Wright in the FORTH computer language. This marks the first time that programs developed in a high-level language (i.e. not in assembler) have been used on either of the UoSAT satellites.

FORTH was chosen because of its inherent ability to manage several tasks running "simultaneously". Testing of the FORTH DIARY began on Monday November 23, with the loading of a preliminary version of the software. This software has been extensively tested on ground-based UoSAT-2 simulators, but this was the first in-orbit operation of the software. Users are encouraged to listen to these tests in case any bugs are uncovered. You will be able to tell that the FORTH DIARY is running because it will transmit a short Special Bulletin in place the bulletin.

The FORTH DIARY was developed in response to several requirements:

- the need for easily maintained DIARY software
- the need to integrate "research software" like the UO-11 attitude control algorithms with "operational software" such as the DIARY schedule facility
- the need for increased facility within satellite software (e.g. trigonometric functions for attitude control).

The FORTH DIARY will introduce enhancements to the UoSAT-2 WOD transmissions. The transmissions will be fully compatible with BBC WOD software developed by UoSAT and marketed by several companies, so casual users of WOD will notice no difference.

More experienced users will notice that the "interleave structure" of the data will have changed. Rather than transmitting interleaves 0 through 7 in standard order, the interleaves will be transmitted as follows:

0,4,2,6,1,7,3,5

Thus, each interleave received will effectively halve the data sampling period of the graphs which appear on your screen, giving a much better view the actual data.

Line zero, which contains the channel numbers, will be transmitted at the beginning of each interleave, rather than just at the beginning of interleave 0. This means that you will have several opportunities to capture the channel numbers for the WOD survey.

Perhaps the greatest innovation of all is to stop the "interleave reset" which usually means that (except on Wednesdays) only interleaves 0 and 1 are ever transmitted. When the DIARY switches to WOD, it will continue to

transmitting the interleave which it was sending when the WOD was last sent, instead of starting again from interleave 0. This means that during the course of a day you should capture data from a greater number of the interleaves than was ever before possible.

Issue Call For Papers For 1988 UK Colloquium

AMSAT-UK and UoSAT are requesting submission of papers for their Third Annual Space Colloquium, to be held at the University of Surrey (UK) 29-31 July 1988. Proceedings of the Colloquium will be published by AMSAT-UK and authors are encouraged to submit papers on all aspects of the Amateur Satellite Program. The Colloquium will feature both a technical session and an operational session, so a broad range of papers is needed.

Suggested topics include:

- Operation through OSCAR and RS satellites
- Scientific, engineering and educational uses of the UoSAT satellites
- Amateur digital communications via satellites
- Design and construction of amateur satellites
- Novel ground station hardware, software or techniques.

Papers must be received NO LATER THAN 2 MAY 1988 to be considered for publication and/or presentation. Send papers to:

Dr. Martin Sweeting
UoSAT Spacecraft Engineering Research Unit
University of Surrey
Guildford Surrey GU2 5XH
United Kingdom

New Field Ops VP Calls For Area Coordinator Handbook Ideas

Newly elected Vice President of Field Operations, Doug Loughmiller, KO5I, announced at the AMSAT-NA Symposium in Detroit that an "Area Coordinator's Handbook" is to be developed. This project is now under way according to Ross Forbes, WB6GFJ, who is helping coordinate the project.

The purpose of the handbook is to provide all Area Coordinators (AC) with a good foundation of information that will help them manage AMSAT activities within their geographical areas. All Area Coordinators are encouraged to submit their ideas for items to be included in the new handbook. Do you remember information that you wish you had known before you became an AC? Do you have any ideas that have noticeably improved AMSAT activities in your area? Do you have advice you would like to pass along to other AC's? Do you have questions you about being an AC?

Input is encouraged from everyone who has been an Area Coordinator, or who is presently an Area Coordinator, or who works with an Area Coordinator. Please send your ideas to Ross Forbes, WB6GFJ, P.O. Box 1, Los Altos, California 94023-0001. Ideas from all ACs is strongly encouraged.

Users Welcome AO-10 Return To Service

AMSAT OSCAR 10 returned to service Monday, November 16 as expected. The return of the veteran spacecraft to service was greeted by a happy community of users who particularly enjoy Mode B operation. Many thousands of QSOs have been made under fine operating conditions according to a sampling of views obtained by *ASR*. According to spacecraft commanders, AO-10 operating conditions will continue to improve over the next several weeks.

However, due to the IHU demise earlier this year, only Mode B operation will be possible. Moreover, for the next month or so, very long eclipses will be occurring. Operation during those periods is expressly prohibited to protect the spacecraft battery. The timing of the eclipses will vary in the coming weeks. This will, in turn, cause changes in the operating schedule. Users will need to keep in close contact with official news sources to insure they are aware of current and planned operating schedules.

Data obtained and analyzed by PY2BJO suggests AO-10's spin rate has slowed to 24 rpm. When the satellite was under IHU control, the spin rate was maintained at about 33 rpm. PY2BJO's analysis was based on stripchart recordings of AO-10's beacon made on November 19. Users should notice no significant changes in operation as a consequence of the apparent slowing of the spin rate.

The operating schedule for AO-10 through early January was published in *ASR* #162, page 2. As always, please insure you use the lowest uplink power levels so as to insure satellite health as well as good communications.

Short Bursts

- According to NF6S, the actual frequency of the PBBS WA6YHJ is 145.09, not 145.01 as listed in *ASR* #162. Thanks to WB6GFJ for the update.

Cross-Satellite Contacts Reported

While many Amateurs consider working satellites one of the hobby's most interesting and satisfying challenges, others are content only when stretching the limits of performance of OSCARs. Thus, while many are pleased to work OSCAR, some try to extend their interest by communication through TWO OSCARs for a QSO.

Two-satellite QSOs are not new. On January 26, 1975, W2BXA and K2QBW (now W2RS) scored history's first-ever (on any satellite) satellite-to-satellite crosslink. That was on a QSO between AMSAT OSCAR 6 and AMSAT OSCAR 7. On August 28, 1986, W2RS reported the first crosslink between AO-10 and FO-12 (See *ASR* #134). Now come reports of a series of crosslinks involving not only AO-10 and FO-12 but the new Russian birds, RS-10/11.

According to G3IOR, G4CUO scored a crosslink with WA3ETD on November 27 when the pair hooked up via a AO-10 to FO-12 link. The 70 cm uplink to AO-10 yielded a 2m downlink which was picked up by FO-12's Mode JA receiver. This in turn resulted in an FO-12 downlink at 70

cm. WA3ETD's XYL N1DYL assisted in the unusual QSO.

Other participants in the crosslink experiments were G3IOR, I8CVS and IØLYL.

In a similar vein and on the same day, November 27, Dave, G4CUO, heard Andy, OK3AU through RS-11 and FO-12. Here, the 2 meter downlink of RS-11 running Mode KT (15m up; 10m and 2m down) was picked up by FO-12's Mode JA receiver. So G3CUO could listen to OK3AU on the FO-12 Mode JA (2m up; 70cm down) 70 cm downlink.

The real optimists are now looking to achieve a three satellite crosslink according to G3IOR. This astounding feat, if accomplished, could set a new mark except it seems likely new government satellites such as TDRS (Tracking and Data Relay Satellite) may already be linking multi-hop crosslinks.

Satellite	Oscar-9
Catalog number	12888
Epoch time:	87323.21193355
Element set:	105
Inclination:	97.6385 deg
RA of node:	344.9869 deg
Eccentricity:	0.0003762
Arg of perigee:	50.0070 deg
Mean anomaly:	310.1456 deg
Mean motion:	15.30654764 rev/day
Decay rate:	4.477e-05 rev/day²
Epoch rev:	34044

Satellite	Oscar-10
Catalog number	14129
Epoch time:	87312.42302134
Element set:	315
Inclination:	27.4464 deg
RA of node:	353.4956 deg
Eccentricity:	0.6027719
Arg of perigee:	254.6927 deg
Mean anomaly:	34.4494 deg
Mean motion:	2.05877122 rev/day
Decay rate:	8.8e-07 rev/day²
Epoch rev:	3313

Satellite	Oscar-11
Catalog number	14781
Epoch time:	87316.65040141
Element set:	269
Inclination:	98.0836 deg
RA of node:	19.4754 deg
Eccentricity:	0.0013954
Arg of perigee:	358.3006 deg
Mean anomaly:	1.8147 deg
Mean motion:	14.62184930 rev/day
Decay rate:	2.80e-06 rev/day²
Epoch rev:	19739

Satellite	Oscar-12
Catalog number	16909
Epoch time:	87324.85660764
Element set:	69
Inclination:	50.0155 deg
RA of node:	263.7549 deg
Eccentricity:	0.0010914
Arg of perigee:	323.6227 deg
Mean anomaly:	36.3858 deg
Mean motion:	12.44394195 rev/day
Decay rate:	-2.5e-07 rev/day²
Epoch rev:	5789

Satellite	RS-5
Catalog number	12999
Epoch time:	87321.04041208
Element set:	451
Inclination:	82.9605 deg
RA of node:	185.2502 deg
Eccentricity:	0.0009836
Arg of perigee:	66.4315 deg
Mean anomaly:	293.7731 deg
Mean motion:	12.05064952 rev/day
Decay rate:	1.2e-07 rev/day²
Epoch rev:	26024

Satellite	RS-7
Catalog number	13001
Epoch time:	87323.07152427
Element set:	352
Inclination:	82.9657 deg
RA of node:	175.7709 deg
Eccentricity:	0.0022941
Arg of perigee:	330.6234 deg
Mean anomaly:	29.3533 deg
Mean motion:	12.08703220 rev/day
Decay rate:	1.2e-07 rev/day²
Epoch rev:	26127

Satellite	RS-10/11
Catalog number	18129
Epoch time:	87319.80670167
Element set:	170
Inclination:	82.9236 deg
RA of node:	306.0682 deg
Eccentricity:	0.0010727
Arg of perigee:	213.6745 deg
Mean anomaly:	146.3732 deg
Mean motion:	13.71887541 rev/day
Decay rate:	7.71e-06 rev/day²
Epoch rev:	1995

Satellite	Meteor 2-14
Catalog number	16735
Epoch time:	87326.06830815
Element set:	200
Inclination:	82.5431 deg
RA of node:	341.9680 deg
Eccentricity:	0.0013998
Arg of perigee:	174.1209 deg
Mean anomaly:	186.0117 deg
Mean motion:	13.83765888 rev/day
Decay rate:	6.0e-08 rev/day²
Epoch rev:	7519

Satellite	Meteor 2-15
Catalog number	17290
Epoch time:	87325.26669942
Element set:	121
Inclination:	82.4674 deg
RA of node:	254.0208 deg
Eccentricity:	0.0014758
Arg of perigee:	70.9253 deg
Mean anomaly:	289.3507 deg
Mean motion:	13.83571422 rev/day
Decay rate:	6.0e-08 rev/day²
Epoch rev:	4425

Satellite	Meteor 2-16
Catalog number	18312
Epoch time:	87326.07200866
Element set:	66
Inclination:	82.5545 deg
RA of node:	313.5589 deg
Eccentricity:	0.0013272
Arg of perigee:	9.9508 deg
Mean anomaly:	350.1906 deg
Mean motion:	13.83329511 rev/day
Decay rate:	7.2e-07 rev/day²
Epoch rev:	1327

Satellite	Meteor 3-1
Catalog number	16191
Epoch time:	87325.81649376
Element set:	716
Inclination:	82.5458 deg
RA of node:	281.1623 deg
Eccentricity:	0.0018783
Arg of perigee:	293.5454 deg
Mean anomaly:	66.3696 deg
Mean motion:	13.16933072 rev/day
Decay rate:	4.4e-07 rev/day²
Epoch rev:	10005

Satellite	noaa-9
Catalog number	15427
Epoch time:	87327.09516122
Element set:	220
Inclination:	99.0720 deg
RA of node:	294.2480 deg
Eccentricity:	0.0015825
Arg of perigee:	116.9892 deg
Mean anomaly:	243.2896 deg
Mean motion:	14.11532855 rev/day
Decay rate:	1.04e-06 rev/day²
Epoch rev:	15173

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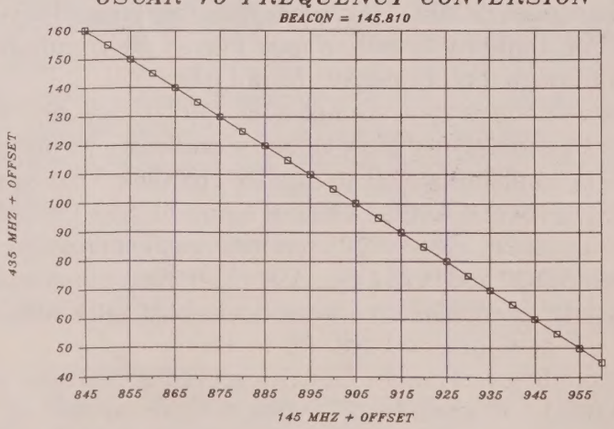

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